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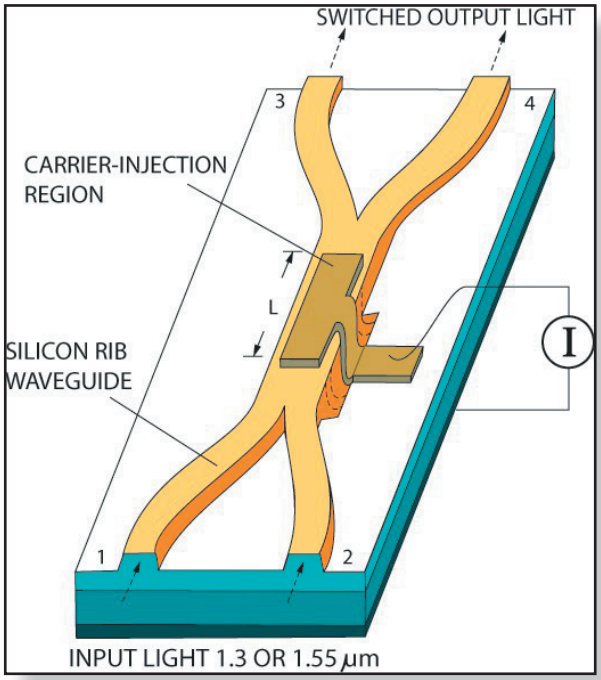
# Success Story

## AFRL TECHNIQUE HELPS INTEL CREATE BREAKTHROUGH DEVICE




Intel Corporation's breakthrough in optical modulator technology—the achievement of greater than 1 GHz modulation rates in silicon devices—exploited results of Air Force in-house laboratory research that was sponsored by AFRL Air Force Office of Scientific Research. To create its high-speed silicon-based device, Intel employed a carrier-induced modulation technique proposed in the 1980s by Dr. Richard Soref, of the AFRL Sensors Directorate's Optoelectronic Technology Branch, Hanscom Air Force Base, Massachusetts. (A schematic of a device reported by Dr. Soref and Mr. Joseph Lorenzo is shown in the illustration.) By "siliconizing" photonics, Intel plans to use its silicon technology and high-volume manufacturing capabilities to advance optical communications. These silicon photonic devices will likely be used to build high-speed busses, as well as connections among servers, personal computers, and other electronic components.

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## Accomplishment

Dr. Soref, an innovator in silicon-based photonics and optoelectronics, has invented many types of silicon-based waveguides and waveguide-integrated photodetectors. Intel plans future investments in silicon photonics, an area in which Dr. Soref and his collaborators are pioneers.

One of the major limitations of silicon photonics has been the relatively low speed of silicon-based optical devices compared to those fabricated from Periodic Table Group III-V semiconductors or lithium niobate. Until 2004, the fastest silicon-based optical modulator demonstrated experimentally had a modulation frequency of only 20 MHz. Now, utilizing the physical mechanism previously investigated by Dr. Soref and his collaborators in slower prototypes, Intel has brought silicon-based light modulation into the GHz frequency range—more than 50 times the previous research record. These advances, along with advanced assembly techniques, will enable silicon components to attain high bandwidth at significantly lower costs than were previously possible.

## Background

Silicon photonics is the technology of making active and passive optical devices from silicon and standard complementary metal oxide semiconductor manufacturing techniques. Fast modulation has been one of the critical technical barriers to realizing practical, on-chip, integrated optical circuits for telecommunications applications.

Sensors
Technology Transfer

## Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-SN-18)